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(54) Article sorting

(57) Articles, for instance of laundry, are classified by providing them with labels including one or more tuned circuit transponders. The labelled articles are automatically sorted by passing them through a duct provided with three orthogonal inductive coils 32, 33, 34 powered with a frequency swept waveform monitored to detect resonance effects occurring whenever a labelled article couples to the field of the coils. Preferably the coils are powered with 120° phase related signals to provide a 'tumbling' field.

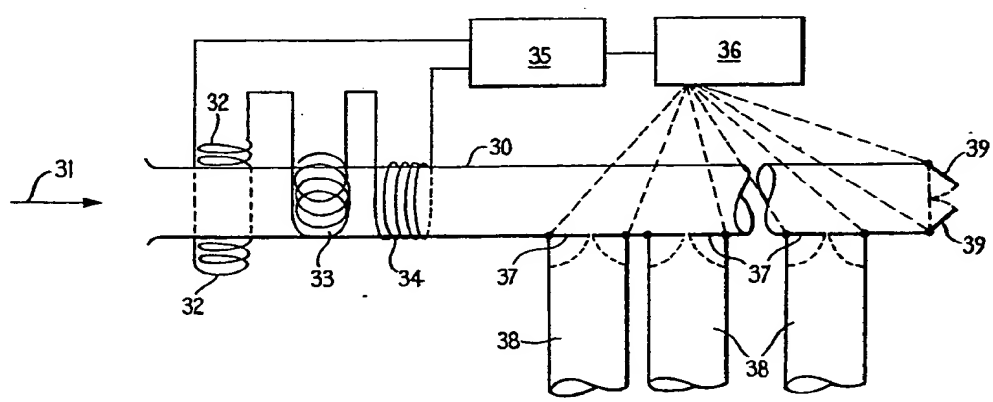

FIG.3

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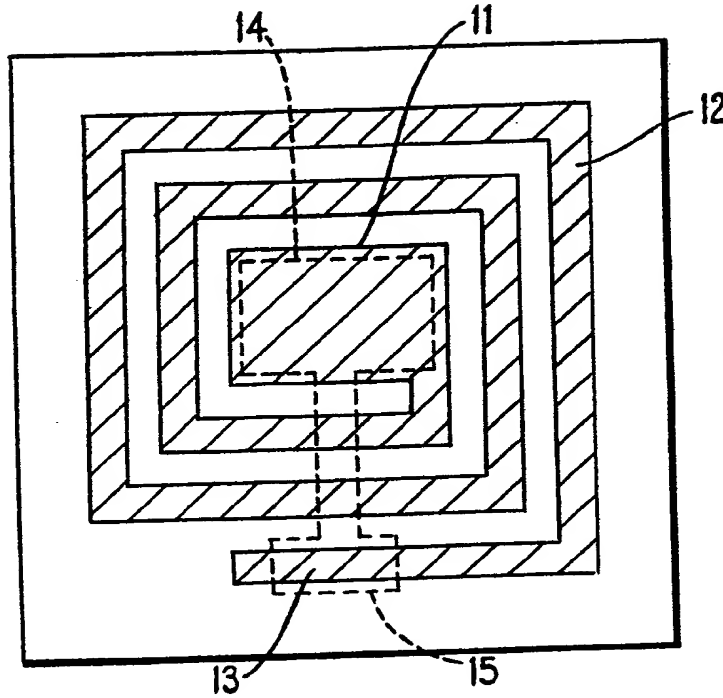

FIG. 1

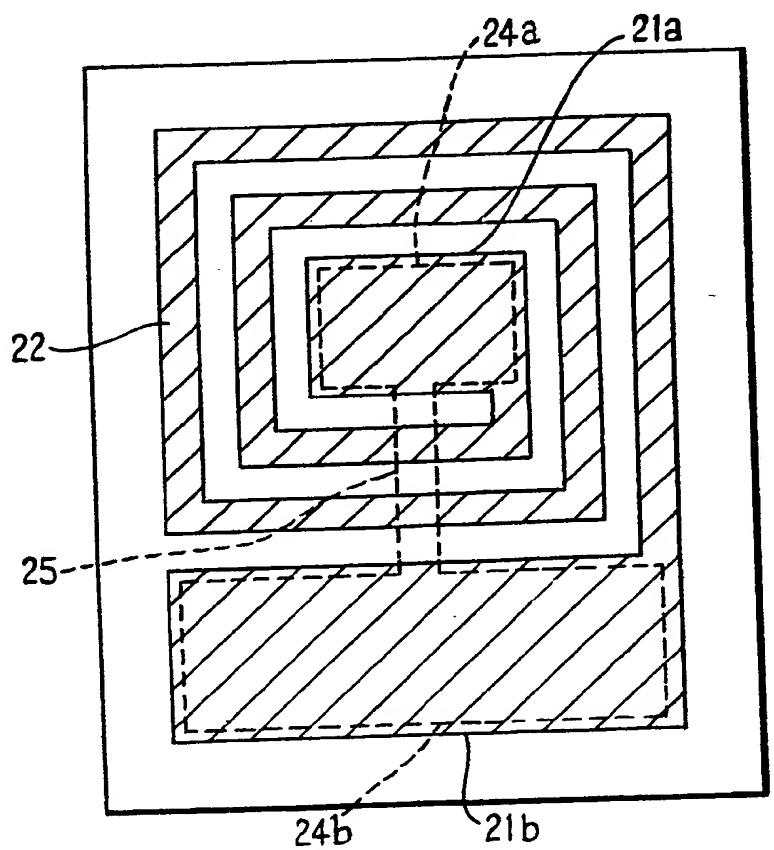

FIG. 2

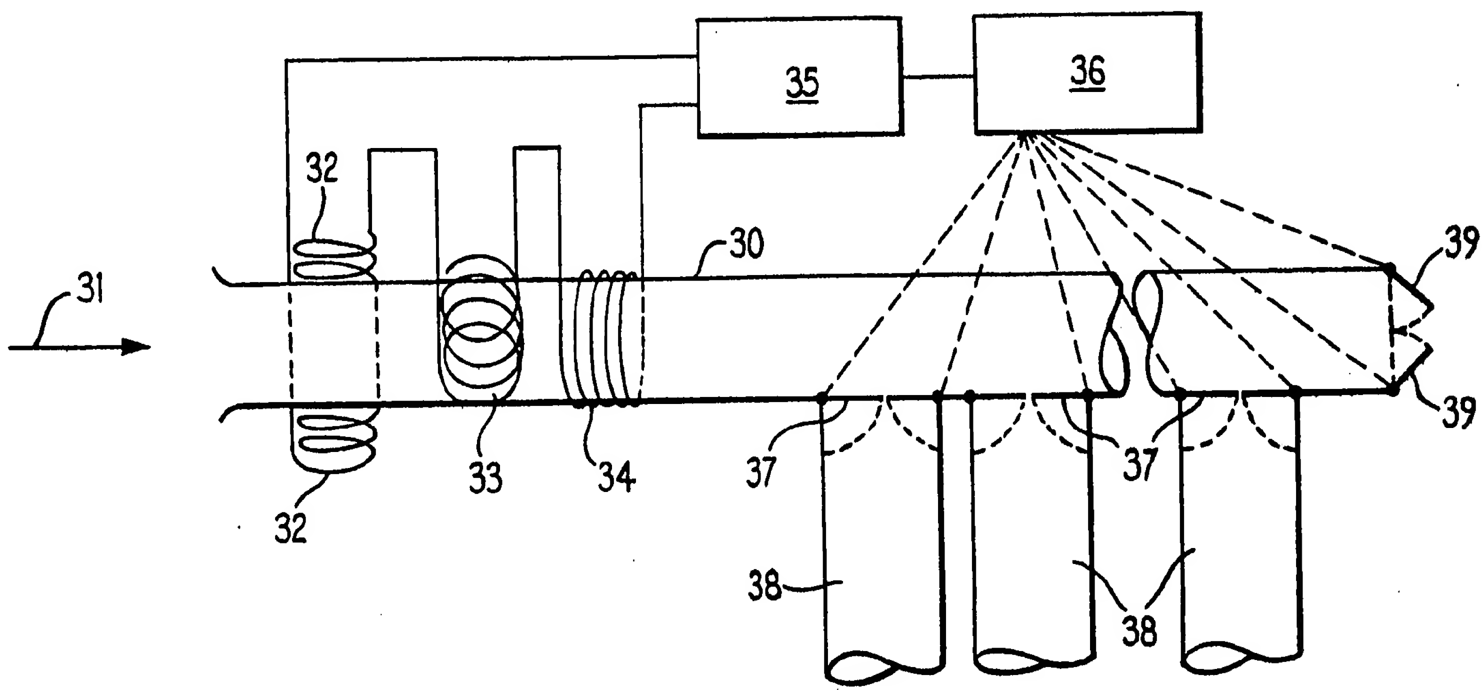

FIG.3

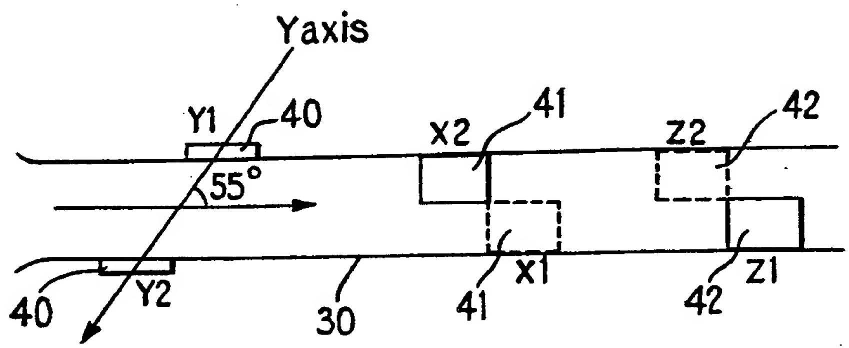
Yaxis
Y1
40
55°
X2
41
Z2
42
Y2
40
30
41
X1
42
Z1

FIG.4

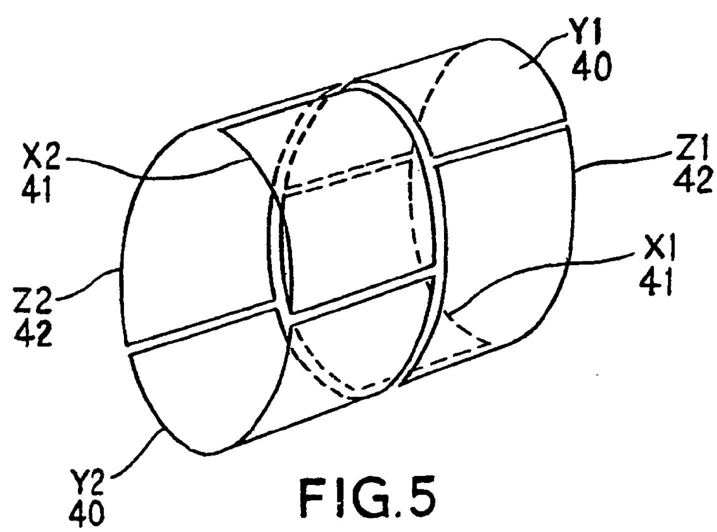
Y1
40
X2
41
Z1
42
Z2
42
X1
41
Y2
40

FIG.5

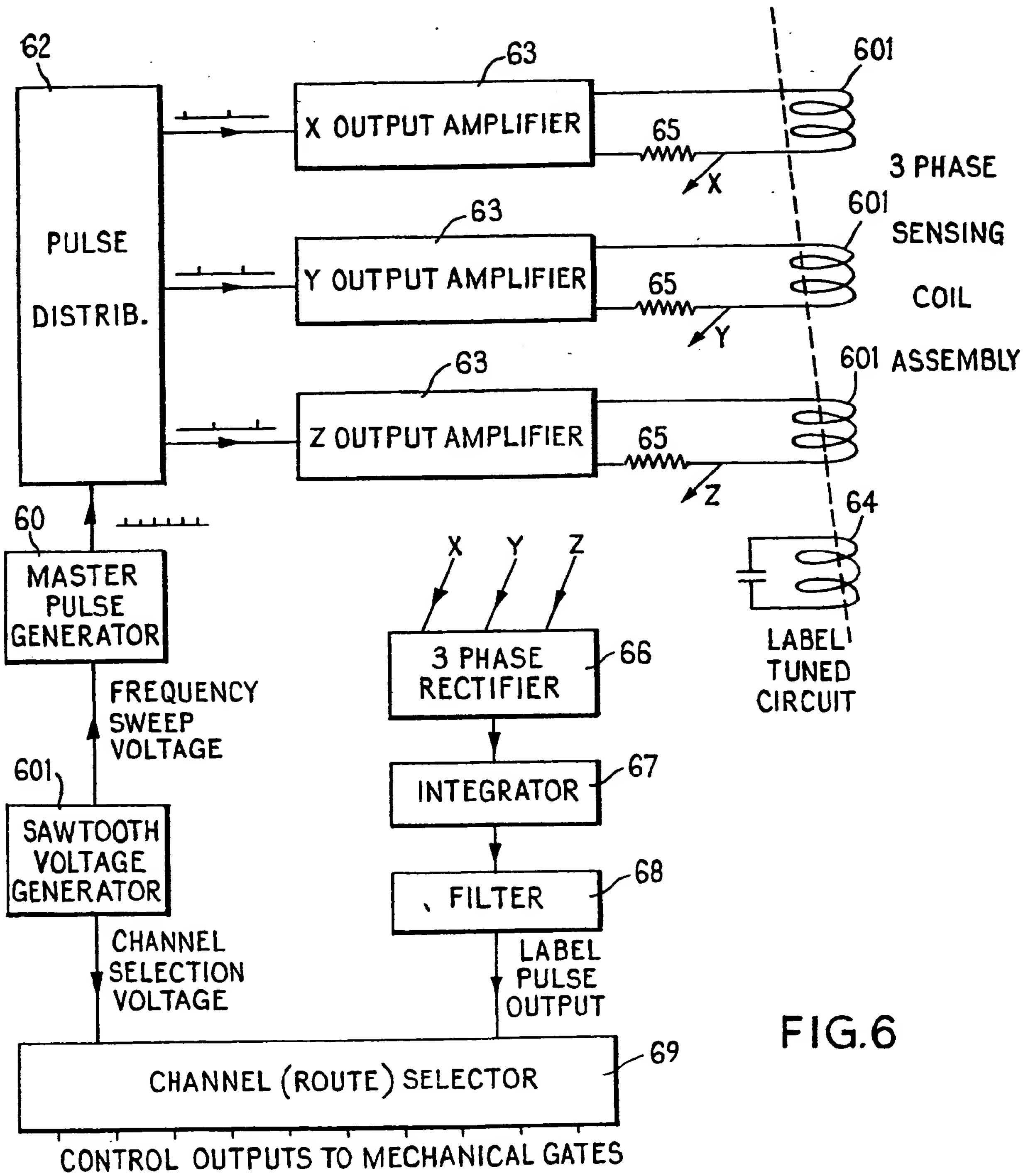
62
PULSE
DISTRIB.
63
X OUTPUT AMPLIFIER
65
X
63
Y OUTPUT AMPLIFIER
65
Y
63
Z OUTPUT AMPLIFIER
65
Z
601
601
601
3 PHASE
SENSING
COIL
ASSEMBLY
64
LABEL
TUNED
CIRCUIT
60
MASTER
PULSE
GENERATOR
FREQUENCY
SWEEP
VOLTAGE
601
SAWTOOTH
VOLTAGE
GENERATOR
CHANNEL
SELECTION
VOLTAGE
X
Y
Z
3 PHASE
RECTIFIER
66
INTEGRATOR
67
FILTER
68
LABEL
PULSE
OUTPUT
CHANNEL (ROUTE) SELECTOR
69
CONTROL OUTPUTS TO MECHANICAL GATES

FIG.6

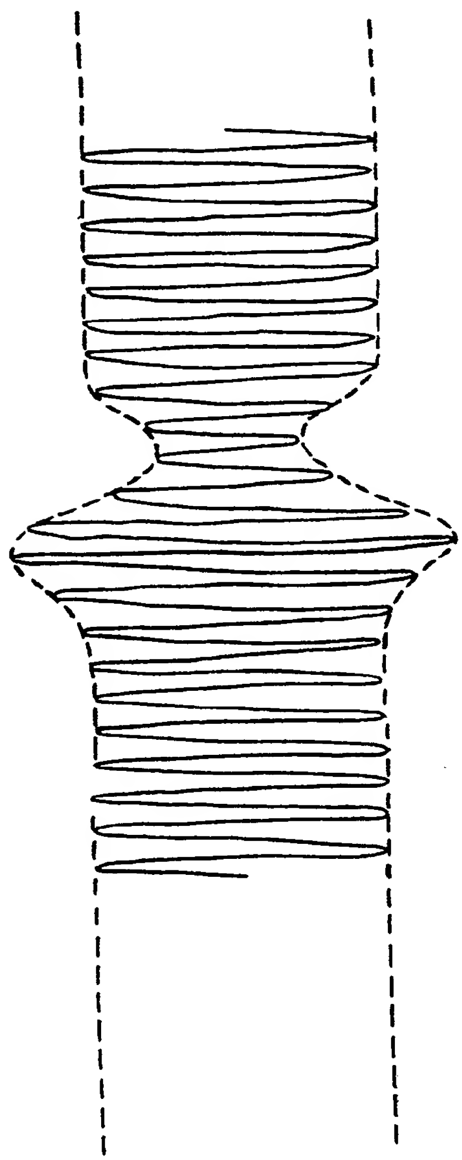

FIG.7

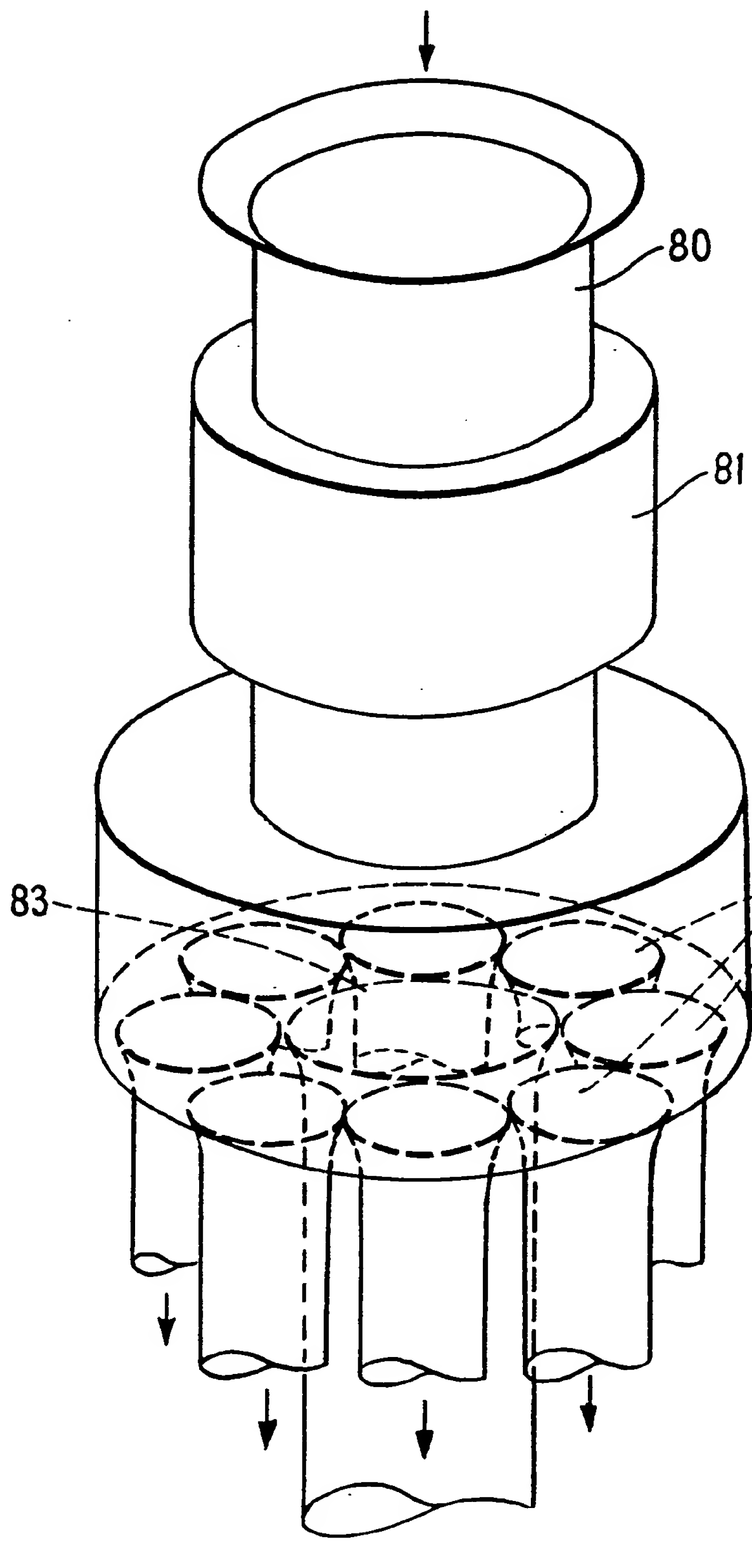

FIG.8

SPECIFICATION

Article sorting

This invention relates to the automatic sorting of articles.

According to the present invention there is provided an automatic sorter for sorting articles each bearing an electromagnetic transponder tuned to a frequency within a particular frequency band assigned to a particular classification attribute of the article which sorter has a duct through which the articles to be sorted are passed wherein the duct is provided with a set of three coils the directions of whose axes do not lie in a common plane, which coils are connected to interrogation means which includes, directly or indirectly to power the coils, a swept or stepped oscillator covering all of the assigned frequency bands of the transponders, and which interrogation means includes monitoring means adapted to provide a signal indicative of within which frequency band is detected a coil resonance effect resulting from one of the transponders inductively coupling at or near its resonant frequency into one or more of the three coils, and wherein the sorter includes a mechanical routing device responsive to said signals from the monitoring means which routing device is adapted to route each article that issues from the duct bearing one of the transponders along a route for articles of the particular category defined by the transponder classification of that article.

The invention also resides in a method of automatically sorting articles each bearing an electromagnetic transponder tuned to a frequency within a particular frequency band assigned to a particular classification attribute of that article, wherein the articles to be sorted are passed through a duct provided with a set of three inductive coils the directions of whose axes do not lie in a common plane, wherein a swept or stepped frequency waveform covering all of the assigned frequency bands of the transponders is applied to the coils while they are monitored for the occurrence of a coil resonance effect resulting from one of the transponders inductively coupling at or near its resonant frequency into one or more of the coils, wherein the frequency band within which such a resonance effect is identified is used to control a routing device to route the article that bears the transponder giving rise to the resonance effect, when it issues from the duct, along a route designated for articles of the particular category defined by the transducer classification of that article.

As an alternative to classifying articles by the assignment of a transponder resonant at a frequency within a single frequency band, the classification may be identified by particular combinations of transponders resonant at differenct frequencies lying within different combinations of frequency bands.

One particular application of the invention, though it is to be clearly understood that this is not the sole application, has in the sorting of laundry articles. Embodiments of the invention will therefore be described in the context of sorting laundry articles.

The description refers to the accompanying drawings, in which:—

Figs. 1 and 2 depict alternative forms of transponder label,

Fig. 3 is a generalised diagram of a sorter,

Figs. 4 and 5 depict alternative arrangements of sorter coil,

Fig. 6 is a block diagram of circuitry for a sorter,

Fig. 7 depicts the coil waveform through resonance, and

Fig. 8 is a schematic diagram showing a possible layout of ducting for sorting.

Laundry articles, being composed of a variety of different natural and synthetic materials, require different cleaning methods for best results and minimum damage. However, such articles are apt to arrive at the laundry mixed indiscriminately in bundles, and must therefore be pre-sorted. The widely differing nature of the individual articles normally requires that this process be carred out by hand, after visual inspection. The present invention can be applied to the performance of this function automatically and without human intervention.

For this application typically it could be assumed that not more than ten different laundering sequences would normally be available, possibly with an overflow for special items needing human attention. Identification of the correct sequence for any given article may be simplified by providing the articles with a permanent label or tag defining the appropriate sequence and hence the route to be followed through the system. Such a label, even bearing only a simple colour or number code, could assist the process of hand sorting, relieving the operator of the need to identify fabrics or read cleaning instructions. However, visual coding requires the article to be lifted or turned so as to bring the label into view, so presents considerable difficulties for a fully-automatic system.

For an automatic system, the label specification might be as follows. The label must be capable of signalling its presence to a detector or interrogator placed at the input to the mechanical sorter. This signal must define the route to be followed by the attached article. The propagation medium must be such as to enable the signal to traverse a distance of at least a few centimetres and to penetrate a reasonable thickness of folded or crumpled fabric. Since the label is to be sewn or otherwise permanently affixed to the article, it must be passive, contain no internal power supply, and ideally should be thin and flexible so as to be unobtrusive when the article is in normal use. Alternatively, if rigid, the label should preferably not exceed the dimensions of a conventional clothes buttom. The label must be immune to damage during normal use, and must survive the successive cleaning processes throughout the life of the article.

The gap between the interrogator and the label might be bridged by acoustic (including ultrasonic) or electromagnetic radiation. The choice is limited by the need to penetrate a significant thickness of fabric should the label be folded within the article. This will exclude acoustic transmission and also visible and infrared light. Although X rays might achieve the desired penetration, the potential

hazards in use, coupled with the problems of achieving the required detector and label characteristics, suggests that this solution should be avoided. This leaves only the radio-frequency end of the electromagnetic spectrum.

To be correctly sorted, the incoming articles must pass, one at a time, within range of the fixed detector or interrogator, which, having recognised the label designation, will output the appropriate signals to define the subsequent route for that article. The label must therefore carry a transponder capable of emitting an identifying signal which is then detected by the interrogator. Being a passive device, the label transponder must derive its energy from a signal initially transmitted by the interrogator. On method of detection requires that a portion of this energy be returned to the interrogator, suitably modulated by the routing code. However, when there is reasonably close inductive coupling between the interrogator and the transponder, separate detection of a return signal becomes unnecessary, and the presence of the transponder can be recognised by its loading effect upon the interrogator transmitter.

The transponder can therefore be no more than a simple tuned circuit, designed to absorb maximum energy at its resonant frequency. If the interrogator is made to transmit at this frequency, inductive coupling between the transponder tuned circuit and the transmitter will result in changes in the transmitter characteristics due to the additional loading. It will be apparent that the actual RF frequency chosen can be such as to favour the design of the transponder tuned circuit, which can be no more than a simple printed circuit configuration on a thin flexible substrate.

By the use of relatively high Q tuned circuits, transponders can be tuned to a number of adjacent frequencies without mutual interference. For example, with a system bandwidth of 1 MHz, transponders can be tuned to, say, 10 MHz, 12 MHz, etc. In operation, each frequency defines a particular laundering sequence. When presented with an article, the interrogator samples each frequency in turn, recognising the correct subsequent route for that article by noting the frequency at which maximum power absorption occurred. On the original assumption that ten alternative laundering sequences must be catered for, a group of ten adjacent frequencies would be adopted.

The sequential sampling of the group of frequencies is preferably achieved by sweeping the interrogating transmitter linearly across the range. This avoids the need for accurate frequency-stabilisation of the transponders, since the absorption peak is always traversed despite any tolerable departure from the nominal position.

The method of generating the control signals for the mechanical gates in the ducting system is illustrated by the following example. In this example the alternative laundering sequences are designated 1 to 10, so that the route 1 gate 1 must be opened, for route 2 gate 2 must be opened and so fourth. The frequency of 10 MHz has been designated for route 1, 11 MHz for route 2, 12 MHz for route 3, etc. The interrogating transmitter is swept repeatedly, at a sufficient speed to complete at least one full cycle during the passage of each article, between the limits 9.5 MHz and 19.5 MHz, thus fully embracing the whole group of transponder frequencies. An electronic pulse distributor is so arranged that, during the transmitter excursion between 9.5 MHz and 10.5 MHz, recognition of an absorption peak will generate an output pulse routed so as to open gate 1. Similarly, during the excursion between 10.5 MHz and 11.5 MHz a detected absorption peak will result in the opening of gate 2, and so forth. To cope with unlabelled or misread articles, it would be expedient to provide a 'longstop' hopper to receive articles for which no gate has been opened.

It will be noted that the separation between adjacent frequencies can be chosen so that a substantial drift in the label tuning can be tolerated without misrouting the article1

An important aspect of the system is that, for correct operation, the label tuned circuit must couple as closely as possible with the transmitter output coil. Unfortunately, as the article passes through the duct, the label tuned circuit must be expected to be randomly orientated, and might therefore have adopted a null position in relation to the transmitter coil, resulting in no absorption of power. This problem is resolved by providing the interrogating transmitter with output coils the directions of whose axes do not lie in a common plane, so that, regardless of orientation, the label is certain of coupling with at least one of the transmitter coils. Preferably these axes are orthogonal.

The preferred form of label is that of a thin, flexible, plastic sheet, bearing inductive and capactive patterns connected to form the tuned circuit. These patterns might be applied as a conductive ink, or etched into a metallic layer previously applied to the plastic. Other conventional printed circuit techniques might also be used. Since the capacitive component will occupy an area on the substrate substantially proportional to its capacitance value, the precise tuning of the circuit may be adjusted by modifying the size of this area. This makes it possible to standardise the label design for the lowest frequency likely to be used, and subsequently adjusting the individual labels to their required frequency by removing an appropriate proportion of the capacitor plate area. Although this removal might take place as a final stage in the original manufacture, either by chemical etching or laser-beam etching under the control of a frequency monitor, a more satisfactory method would be to make the adjustment by cutting off, or punching out, the requisite amount of capacitor area immediately prior to attaching the label to the article. This could be done by unskilled operators, by placing a standard label into a simple and inexpensive hand punch having keys designating the several route alternatives.

In some circumstances the label as so far described may require the addition of a protective layer of plastic over the circuit pattern. Additional environmental protection can be given by enclosing the printed substrate in a rugged outer envelope or casing designated to resist the cleaning processes. In such a case, the punch pattern on the substrate

can be made to remain visible through the casing to identify the route number to a human sorter in case of system failure. Alternatively, an external colour code may be used to serve this purpose.

The ultimate design of the label resonator will, for practical reasons, tend to dictate the actual range of frequencies adopted. Although, in the foregoing description, a median value around 10 MHz has been assumed, economical simplicity in the printed circuit design might bias the choice towards the microwave region.

Two examples of label layout are depicted in Figures 1 and 2. A printed circuit track consists of a central pad 11 encircled by a spiral tail 12. The central pad forms one plate of a capacitor while the tail forms the inductor. The printed circuit track is covered with an insulating layer except in the region 13 near the end of the tail, and then this is overlaid by a further conductor pattern depicted by broken lines, this comprises a pad 14, to form the second plate of the capacitor, and a tail 15 to make electrical connection with the exposed region 13.

The layout of Figure 2 is similar to that of Figure 1 but in this instance the printed circuit track has a pair of pads 21a and 21b at opposite ends of a spiral 22. The entire track is covered with an insulating layer, and this is overlaid by a further conductor pattern depicted by broken lines. This comprises a pair of pads 24a and 24b linked by a strap 25. In this way the requisite capacitance of the tuned circuit is formed by the series combination of two capacitors, and the construction avoids any need to establish any direct electrical connection between the conductors on the two sides of the insulating layer.

Any actual implementation of a complete system must be subject to the mechanical design and layout of the actual laundry installation. Nevertheless, the schematic layout of Figures 3 and 4 involve making only certain basic assumptions which should remain valid in most instances. Figure 3 illustrates the operating sequence. Articles are fed singly into an input duct 30 in the direction of the arrow 31. Over the sensing region, this duct is made as small in diameter as the nature of the articles permits, so as to achieve maximum coupling between the label tuned circuit and the transmitter coils embracing the duct. To overcome the risk of an unfavourable label orientation, the article is made to pass successively through three mutually-orthogonal transmitter coils. For ease of initial explanation, these are assumed to comprise, in Fig. 1, an X coil 32, formed in two halves, generating a field whose axis traverses the horizontal diameter of the duct, a Y coil 33, also formed in two halves, whose field axis traverses the vertical diameter, and a Z coil 34 wound around the duct so that its field axis coincides with that of the duct.

The coils are powdered by a swept oscillator 35 as the article passes through the sensing region, the transponder label tuned circuit will absorb energy at its characteristic frequency from at least one of the transmitter coils. In the manner described earlier an electronic pulse distributor 36 monitors the coil loading and is arranged to control the temporary opening of the appropriate one of a set of ten mechanical gates 37 whenever it detects a resonance effect, thereby directing the relevant article along the appropriate route provided by ducts 38. At other times a longstop gate 39 is left open, but this closes whenever any gate 37 is opened.

It must be noted that, since the X, Y, and Z coils normally carry the same signal, they must be positioned so that their fields do not interact. If, for example, they were superimposed in the manner of a television deflection yoke, the fields would merely combine to produce a single field having its axis at the appropriate resultant angle. This would not achieve the desired end.

There are certain disadvantages in disposing the field axes as described in Fig. 3, where the Z coil must necessarily be of a different design from the X and Y coils, and the field distribution might, in consequency, be dissimilar. A preferred alternative is, while retaining the orthogonal relationship between the X, Y and Z coils, to alter the angle of the duct axis so as to lie symmetrically between the three field axes. Thus, each field axis would make an angle of approximately 55° with the duct axis and, when viewed along the duct axis, would appear to enter the duct axis at 120° intervals. This enables a very convenient disposition of the transmitter coils, all of which may be identical. Fig. 4 shows the manner in which a pair of coil halves, while lying snugly against the duct wall, may be so displaced as to generated a field at the desired 55° angle. This is most clearly illustrated by the Y pair in the diagram, the Xand Z pairs being similar, but rotated plus and minus 120° respectively around the duct.

As before, if the three coils formed by coil halves 40, 41, and 42, are fed with the same transmitter waveform, they must be staggered along the duct so that their fields do not interact. However, if the X, Y and Z coils are fed with three separate phases, displaced at 120°, a rotating field pattern will be established, somewhat as in a three phase electric motor. This would have an effect equivalent to tumbling the label tuned circuit. In this case, since their resultant field axis will be gyrating in such a manner as to cover all possible label orientations, the three coils formed by coil halves 40, 41, and 42 may be nested, as illustrated in Figure 5, such that their axes intersect at a single point on the axis of the duct.

A suitable transmitter oscillator 35 (Figure 3) to drive the coils might have its tuning capacitor shunted by a varactor variable capacitance diode, in which the capacitance, and hence the frequency of the tuned circuit, is varied by varying the applied voltage. To sweep the desired range a ramp or sawtooth voltage should be applied. This will ensure that the transmitted signal moves progressively across each channel (frequency band) in turn, in search of the label tuning peak. This could alternatively be achieved by the application of a 'staircase' waveform to step the signal to the nominal centre frequency of each channel in turn. However this latter approach is not normally to be preferred because it imposes rigid requirements upon the tuning accuracy of the transmitter and all the labels.

Distribution of the control signals to mechanical gates 37 may be achieved by applying the control

sawtooth to a set of voltage level detectors, arranged to turn on and off successively over ten equal increments of the ramp. As earlier described, a label tuned to lie within the limits of any given channel will open the gate appropriate to that channel. It will be seen to be advantageous to make the passband of each channel comfortably wider than the bandwidth of the label tuned circuits, since the system will still operate correctly provided that it finds the absorption peak somewhere within the proper channel, despite fortuitous mistuning of the labels.

The swept master oscillator need not feed the sensing coils directly. A buffer amplifier can be interposed, provided that the Q of the output tuned circuit is made such that the drive frequency sweep can be followed without loss of output amplitude. For a three phase system, the advantage in using three buffer amplifiers is the ability to establish the 120° phase shifts at a low power level and at a point immune to the effects of label loading. Where buffer amplifiers are used, the loading due to the label will naturally be revealed by an increase in the amplifier current instead of in the oscillator current.

A preferred way of driving the three coils in such a way as to give precise control of the 120° angle between their relative phases is illustrated in Figure 6. The master oscillator of this drive circuit is provided by a pulse generator 60 having a tunable pulse repetition frequency, controlled by a sawtooth or triangular wave voltage generator 601. This operates at three times the frequency required to drive the X, Y, and Z sensing coils 61. The output of the oscillator 60 is fed to a distributor 62 which distributes the pulses between three output amplifiers 63 so that the X output amplifier receives every third pulse, the Y output amplifier receives each oscillator pulse occurring next after one fed to the X output amplifier, and the Z output amplifier receives each oscillator pulse occurring next after one fed to the Y output amplifier. The outputs of the amplifiers are used to drive the coils.

In the foregoing description reference has been made to the increased extraction of power from the coils when their driving frequency matches the resonant frequency of a tuned circuit coupled to the coils, such as that diagrammatically depicted at 64. In practice however the coupling of the tuned circuit of a label 64 with any of the coils is unlikely to be anywhere near as great as that of a transformer, and hence the increase in power consumption due to dissipation in the label is liable to be quite small compared with the power radiated by the coils. For this reason it is generally found preferably to detect the resonance effects of a coupled tuned circuit by monitoring either the current flow in the coils or the potential developed across them, the choice depending upon the impedance of the drive circuitry. Figure 6 shows the arrangement for measuring the current flow using a series connected resistor 65. As the frequency applied to the coil goes through the resonance condition the phase of the impedance reflected back into the coil by the resonant circuit changes sign producing a current or voltage modulation of the drive waveform of the type depicted schematically in Figure 7. A three-phase rectifier 66 and intergrator 67 combine to produce a direct voltage proportional to the mean current of the three coils. The integration time constant is such as to eliminate the drive pulse waveform while allowing passage of the lower frequency component provided by the envelope of the modulation. A subsequent high pass filter 68 may be used to remove the direct current component leaving only the resonance effect pulse to be routed by a channel selection circuit 69 to operate the appropriated mechanical gate. Operation of the channel selection circuit is regulated by a signal derived from the voltage waveform generator 601 used to control the pulse repetition frequency of the pulse generator 60.

For clarity, Figure 3 shows the output gates placed successively along the output duct. If this arrangement were adopted in practice, a problem might arise from the transit time of the article along the duct, since articles destined for the most distant gate will take longer to arrive than those destined for the nearer gates. This could reduce the speed of operation, since only one article can pass through the sensor/gate complex at a time. Although the problem is similar to that of a punched-card sorter, where electronic time delays are introduced to ensure that a gate only opens as the intended card approaches it, the disparate size and shape of laundry articles would make it difficult to ensure their requisite constant velocity along the duct, particularly if pneumatic suction were used – a mode of transport which, in all other respects, would appear to be ideal. The preferred solution lies in adopting the arrangement shown in Figure 7. Here the articles are placed singly into a vertically-disposed input duct 80, to fall, or be sucked, past the sensing head 81 containing the three coils. The output gates 82 are arranged in a circle immediately beneath, so as to be equedistant from the sensing head. Suction to pull the article through the sensing-head would be provided via a 'longstop' gate 73, which would remain open until a label were sensed. The act of detecting a label would immediately close the longstop gate and open the appropriate output gate. Suitably designed, the system can fuction as rapidly as articles can be thrown singly into the intake duct.

Errors in sorting are liable to occur if two articles of different classification arrive at the gates so closely spaced in time that the second article arrives there before the gate appropriate to the classification of the first article has had time to close. This problem can be avoided by providing a circuit to inhibit all the output gates 72 whenever labels tuned to different channels are detected within a predetermined minimum time interval. Under these circumstances insufficiently separated articles of different classes will pass automatically through the 'longstop' gate for subsequent sorting action, while insufficiently separated articles of the same class will be directed through their appropriate gate.

The tuned circuit of the label is not necessarily provided by an electrically conductive circuit but may be provided by other types of devices selective electromagnetic absorption. One example is provided by a piezo-electric crystal. Typically of quartz, cut to such dimensions to function as a tuned circuit

at the desired frequency. For operation in the frequency range 1 to 10 MHz the crystal might be about 25 mm in diameter and about 1 mm thick. No electrodes are required but absorption of energy is found to take place merely by placing the disc within the field of a transmitter driven at the resonant frequency of the disc. However, although such a device might be preferable in applications where there is a risk of severe chemical attack, its cost is likely to debar its use from conventional laundry application. A further example is a suitably dimensioned magnetro-strictive device but again cost is likely to debar its use from all but very special applications. A typical magneto-strictive device would of course be typically operated at much lower frequencies than contemplated for the printed circuit type tuned circuit.

The foregoing specific description has related to a sorter for articles each classified by a single transponder and hence the number of frequency bands required has been equal to the number of classes within the classification system. If this number of classes becomes too big to be readily manageable in terms of the bandwidth requirements, a coded system may be employed in which each class is defined by a specific combination of transponders resonant at different frequencies lying within different combinations of frequency bands. A drawback of using such a combination system is that it is not possible to use the system for preventing misrouting of too-closely spaced articles that has been described above for use with the single transponder system. Where a combination system is to be employed the separate transponders of an article will generally, but not necessarily, be mounted on a single label.

CLAIMS

1. An automatic sorter for sorting articles each bearing an electromagnetic transponder tuned to a frequency within a particular frequency band assigned to a particular classification attribute of that article which sorter has a duct through which the articles to be sorted are passed wherein the duct is provided with a set of three coils the directions of whose axes do not lie in a common plane, which coils are connected to interrogation means which includes, directly or indirectly to power the coils, a swept or stepped oscillator covering all of the assigned frequency bands of the transponders, and which interrogation means includes monitoring means adapted to provide a signal indicative of within which frequency band is detected a coil resonance effect resulting from one of the transponders inductively coupling at or near its resonant frequency into one or more of the three coils, and wherein the sorter includes a mechanical routing device responsive to said signals from the monitoring means which routing device is adapted to route each article that issues from the duct bearing one of the transponders along a route for articles of the particular category defined by the transponder classification of that article.

2. An automatic sorter as claimed in claim 1 and including a discriminator which adapted to cause the routing device to route articles along a route for articles requiring further sorting whenever it senses that two or more articles are passing through the duct producing coil resonance effects within different frequency bands which increases are separated in time by an interval of less than a predetermined amount.

3. An automatic sorter for sorting articles each bearing a plurality of electromagnetic transponders tuned to frequencies lying within different frequency bands in a combination assigned to a particular classification attribute of that article, which sorter has a duct through which the articles to be sorted are passed, wherein the duct is provided with a set of three inductive coils the direction of whose axes do not lie in a common plane, which coils are connected to interrogation means which includes, directly or indirectly to power the coils, a swept or stepped oscillator covering all of the assigned frequency bands of the transponders, and which interrogation means includes monitoring means adapted to provide a signal indicative of the combination of frequency bands within which coil resonance effects are detected resulting from each of the plurality of said transducers of an article individually coupling at or near its resonant frequency into one or more of the three coils, and wherein the sorter includes a mechanical routing device responsive to said signals from the monitoring means, which routing device is adapted to route each article that issues from the duct bearing a plurality of said transducers along a route designated for articles of the particular category defined by the transducer classification of that article.

4. An automatic sorter as claimed in claim 1, 2, or 3, wherein the axes of the three coils are orthogonal.

5. An automatic sorter as claimed in claim 4 wherein the angle between the duct axis and the axis of the coil is the same for each of the three orthogonal coils.

6. An automatic sorter as claimed in claim 4 or 5 wherein there is a 120° phase angle between the power supplies to each pair of the three orthogonal coils.

7. An automatic sorter as claimed in claim 5 wherein the three orthogonal coils are nested such that their axes intersect at a single point on the axis of the duct, and wherein there is a 120° phase angle between the power supplies to each pair of the three orthogonal coils.

8. A sorter as claimed in claim 6 or 7 wherein the oscillator is a pulse oscillator connected to a pulse distributor adapted to apply every third pulse from the oscillator via an amplifier to one of the three coils, and respectively every next and next but one of the oscillator pulses via separate amplifiers to the other two coils.

9. A sorter as claimed in any preceding claim wherein the monitoring means is adapted to detect coil resonance effects by monitoring the current flow through the coils.

10. A sorter as claimed in any claim of claims 1 to 8 wherein the monitoring means is adapted to detect coil resonance effects by monitoring the voltage developed across the coils.

11. A sorter substantially as hereinbefore described with reference to the accompanying drawings.

12. A sorter for sorting articles of laundry which sorter is as claimed in any preceding claim.

13. A method of automatically sorting articles each bearing an electromagnetic transponder tuned to a frequency within a particular frequency band assigned to a particular classification attribute of that article, wherein the articles to be sorted are passed through a duct provided with a set of three inductive coils the directions of whose axes do not lie in a common plane, wherein a swept or stepped frequency waveform covering all of the assigned frequency bands of the transponders is applied to the coils while they are monitored for the occurrence of a coil resonance effect resulting from one of the transponders inductively coupling at or near its resonant frequency into one or more of the coils, wherein the frequency band within which such a resonance effect is identified is used to control a routing device to route the article that bears the transponder giving rise to the resonance effect, when it issues from the duct, along a route designated for articles of the particular category defined by the transducer classification of that article.

14. A method of automatically sorting articles each bearing a plurality of electromagnetic transponders tuned to frequencies lying within different frequency bands in a combination assigned to a particular classification attribute of that article, wherein the articles to be sorted are passed through a duct provided with a set of three inductive coils the directions of whose axes do not lie in a common plane, wherein a swept or stepped frequency waveform covering all of the assigned frequency bands of the transponders is applied to the coils while they are monitored for the occurrence of a coil resonance effect resulting from each one of the transponders of an article coupling at or near its resonant frequency into one or more of the coils, wherein the combination of frequency bands within which such resonance effects are identified is used to control a routing device to route the article that bears the transponder combination giving rise to the resonance effects, when it issues from the duct, along a route designated for articles of the particular category defined by the transducer classification of that article.

15. A method as claimed in claim 13 or 14 wherein the three coil axes are orthogonal and wherein there is a 120° phase angle between the supplies of power to the three coils.

16. A method as claimed in claim 13, 14 or 15 wherein the coils are monitored for coil resonance effects by monitoring the current flow therethrough.

17. A method as claimed in claim 13, 14 or 15, wherein the coils are monitored by monitoring the voltage developed thereacross.

18. A method of automatically sorting articles which method is substantially as hereinbefore described with reference to the accompanying drawings.

19. A method of automatically sorting articles of laundry which method is as claimed in claim 13, 14, 15, 16, 17, or 18.

20. In association with a sorter as claimed in any claim of claims 1 to 12 a set of labels bearing one or more transponders having tuned resonant frequencies lying in different ones of said frequency bands of the sorter.

21. A set of labels in association as claimed in claim 20 wherein the transponders are provided by printed circuits.

22. A set of labels in association as claimed in claim 20 wherein the transponders are provided by piezo-electric resonators.

23. A set of labels in association as claimed in claim 20 wherein the transponders are magnetostrictive resonators.

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